INVENTORYING HABITATS AND RATING THEIR VALUE FOR WILDLIFE SPECIES

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ABSTRACT

A team of experienced biologists developed line charts to inventory the important components of wildlife habitat and transformation charts to convert the inventoried characteristics to habitat values for specific species for a Maryland Piedmont watershed. The line chart system gave results equivalent to the procedure recently developed by the U.S. Fish and Wildlife Service with less field time. In addition, the line charts display the basis for all conclusions, provide a simplified base for determining future conditions, and are easily adapted to computer analysis. The value ratings from this system provide a firm foundation for assessing the effects on wildlife habitat of water resource project alternatives and for planning any needed mitigating or compensation measures.

A uniform system for inventorying wildlife habitat that is acceptable to the layman and to professionals in various disciplines is needed for land use and management planning. Since the passage of the National Environmental Policy Act of 1969 and implementation of the Water Resource Council's "Principles and Standards", it is necessary to analyze wildlife habitat objectively as part of environmental assessment procedures for any federally funded project, especially water resource developments.

Techniques used to evaluate wildlife habitat vary considerably. *Wildlife Investigation Techniques* (Giles, ed. 1969), a Wildlife Society publication, describes several methods and references others. Plant communities characterized by these methods are meaningful to biologists evaluating wildlife habitat. This publication also describes numerous methods for determining wildlife populations. But most procedures used in the past are too time-consuming for practical use in large areas on a regular basis. An experienced wildlife biologist can study an area and make a good qualitative estimate of the condition of the habitat for the species with which he is most familiar. It is often difficult, however, to gain complete agreement between two or more biologists on values because of the complexity inherent in any habitat. This often leads to difficulties when dealing with the public or professionals in other disciplines who generally work with finite methods for reaching conclusions.

A usable system must be able to assign a value figure for the habitat for individual wildlife species and groups of species by unit area. Such figures must display the effects of planned projects on the habitat so that various alternatives can be compared. The system must show the effectiveness of mitigating proposals and the amount of compensation needed to offset significant losses. The system should be one that can: (1) be accomplished with equal accuracy by field personnel with varying degrees of experience; (2) give results that can be duplicated by different investigators at different seasons of the year; (3) be accomplished with limited amounts of time and money; (4) display in a logical sequence the basis for all conclusions; and (5) use information collected by specialists in other fields and generate data for use by others as an integral part of the environmental assessment process.

Hamor (1970) and Daniel and Lamaire (1974) used a similar system for evaluating reservoir sites. To derive the ratings, a survey team of experienced biologists subjectively analyzes the management condition and interspersion of the habitat types following guidelines, and rates their value for indigenous wildlife. This type of evaluation depends on the combined judgment of a group of experienced biologists examining the habitat in the field. They must be intimately familiar with the vegetation and the needs of all important wildlife species in the area. They must also weight their evaluations toward those species considered most important. Such subjective evaluations may result in biased evaluation of habitat quality. It is difficult for different investigators to duplicate accurately the results. Professionals in other fields, such as foresters or engineers, find it difficult to accept the results when they are accustomed to working with more precise methods.

Habitat evaluation procedures (U.S. Fish and Wildlife Service, 1976) were developed for use by the U.S. Fish and Wildlife Service, Division of Ecological Services ". . . to provide a uniform, nationwide method for determining impacts on fish and wildlife and their habitat arising from water development projects." These procedures require a team of experienced field biologists to (1) delineate the major habitat types in the evaluation area, (2) determine the acreage of each, (3) select approximately 10 of the most biologically important wildlife species or groups of species, (4) develop or modify predeveloped key criteria for habitat values for each wildlife species or group of species, and then by group consensus, (5) rate a representative number of sites in each habitat, on a 1 to 10 scale, for the selected wildlife species or group of species. The method works well with a team of experienced field biologists who have the time to examine in detail an adequate number of sites. However, any team gains experience as they do the job so it may become difficult to compare the results from the first sites with the last. Also, the individuals on the team vary in their knowledge of certain species and in their ability to convince the rest of the team to see it their way. Further, it is uncertain if the same team, much less a different team, would arrive at exactly the same conclusions at different seasons of the year. A major weakness of the U.S. Fish and Wildlife system is the difficulty of displaying the basis for the values given each site so other biologists, professionals in other fields, and the public can understand them.

The U.S. Army Corps of Engineers (1976) in their tentative habitat evaluation system specified inventorying habitat characteristics and measuring interspersion parameters. Each factor is assigned a general wildlife value using transformation curves and weighted as to its relative importance. The weighted values are then averaged to give the value of the habitat in the study area for wildlife on a 0.0 to 1.0 scale.

Whitaker and McCuen (1975) analyzed wildlife habitat by inventorying the major components and giving each a value and weighting each component to relate its importance to groups of wildlife species. The weighted geometric mean provided an index of habitat quality. Such a model can be calibrated for individual species. The methodology as presented is an efficient way to evaluate large regions or watersheds. The same basic model can also be used to analyze data for smaller areas such as reservoir sites. A more detailed examination, however, of the habitat conditions is needed in smaller areas where the impact is greatest.

The authors expressed their appreciation to John Bains, Bill Larned, Bruce Nichols, and John Brush who assisted in the field work and in preparing the habitat value rating criteria. This system is being used on certain watersheds in Maryland, but it has not been accepted as the official system of the USDA, Soil Conservation Service.

PROCEDURES

As part of the environmental assessment of the potential effects of the proposed construction of reservoirs in the Seneca Creek Watershed, located 50 km. north of

Washington, D.C., it was necessary to determine the effects on upland wildlife habitat. Wildlife habitat acre-values of the 34,500 ha. watershed as a whole were being evaluated by the Whitaker and McCuen (1975) methodology. For reservoir site investigations, the U.S. Fish & Wildlife Service (1976) procedures were to be used.

To record the habitat characteristics on which habitat value judgments were made, a series of line charts for each major habitat type was developed (Fig. 1). Such line charts can be derived for any habitat type in any region. Those presented here are suitable for the lower Piedmont hardwoods region of the eastern United States. Copies of the figure with appropriate headings were used as field forms. The team of investigators marked on the appropriate lines the condition for the site or field. These values are either estimated ocularly by experienced field personnel or determined quantitatively by using appropriate plot survey methods. Field judgments of a group of wildlife biologists, foresters, and a naturalist were used in this study of reservoir sites.

The inventory line charts record those characteristics from which the quality of the habitat for important wildlife species can be judged. Percentage composition, density, and percentage coverage line charts are easily derived. Tree stand and other species composition lines were generated to record those species groupings common to the Piedmont. Generally, they show the direction that natural succession will take, such as the one for old fields.

Transformation methods to convert the line chart data directly to habitat values for each wildlife species being used for the U.S. Fish and Wildlife system were developed. The group of professional field biologists working on the wildlife habitat assessment assigned values, on a 0.0 to 1.0 scale, for the varying conditions of each habitat component. The values used for some species using old field vegetative type are shown in Fig. 2.

Some habitat types are inventoried by a line chart for each important component. Each component must be evaluated separately for each species and the values combined for each site. The transformation line charts for evaluating woodland inventory line charts for white-tailed deer are shown in Fig. 3. For other species, such as snakes, only two or three of the component inventory line charts were used. The values derived for each component must be combined and weighted as to their relative importance to the species. Table 1 shows the formula used to obtain the mean weighted value of the woodland habitat for white-tailed deer. Similar component evaluation weighting procedures were used for all species.

RESULTS

The values determined using the Fish and Wildlife Service system of group judgment in the field and those from the line chart system are shown in Table 2 for Old Field habitat. The results obtained were not significantly different. Since the same group of experienced biologists determined the values at the same time, we did not expect that they would be. The line charts in the support files display basic inventory information for each habitat type investigated along with the values placed on each component to support all conclusions. Much of the inventory data, such as cropping patterns, pasture conditions, and forest composition, is being used by specialists in other disciplines involved in the environmental assessment process.

The mean value for all species represents the land use and management conditions of the model used by Whitaker and McCuen (1975). The interspersion of habitat types and the acreage of each is also important to many wildlife species. The factors were evaluated and summarized according to their methodology. Since the percentage of each habitat type and its interspersion was similar in the two sites investigated, it did not significantly affect the rating.

DISCUSSION

We believe that the inventory and the value transformation line charts accurately represent conditions in the area investigated. All biologists may not agree with the details because of different background and experience. Realistic line chart and value ratings can be developed for regions of generally similar plant communities, such as for the ecoregions

WOODLAND TRACT INVENTORY DATA

Tree Stand Characteristics

Average DBH of Canopy Trees (Inches)

4	8	12	16	20	24	28

Species Composition of Deciduous Trees

maple and sweet gum	over 75% yellow poplar	mixture of non-nut producing species	low diversity oaks and/or hickory dominant	mixture of 3 or more oaks, including white, dominant	mixture with a few, 10%, beech	beech dominate

Understory Characteristics

Understory (woody vegetation less than 5 ft. high) % Ground Cover

0	25	50	75	100

Understory Species Composition

wide variety of species present including briers and vines	wide variety including ones like dogwood and bush cranberry	wide variety of species dominate, no briers etc.	three species dominate	two species dominate	one species dominate

Honeysuckle - % Ground Cover

0	25	50	75	100

WOODLAND TRACT INVENTORY DATA

Continued

Herbaceous Ground Cover

Herbaceous % Ground Cover

0	25	50	75	100

Herbaceous - Species Composition

fine grass and sedges dominate	large species of grasses and sedges dominate	wide variety of grasses, sedges and forbs	fine grasses and spring forbs	spring forbs dominate

Organic Ground Cover

bare ground "no litter"	mostly covered with leaf mulch	complete leaf mulch & a few (5%) logs & sticks	thick leaf mulch and 20% logs & stick coverage	thick leaf mulch & 50% logs & sticks	light leaf coverage & much logs & sticks	ground covered with only dead branches and logs

Rock Abundance %

0	10	15	30	50	100

Moisture Condition

Soil Site Moisture

dry rocky or bare hillside	drought tolerant ground cover (a few fine grasses)	damp woods (solomon's seal, bloodroot, hepatica, etc.)	moist woods (jack-in-the-pulpit, jewel weed)	wet bottom floodplain or spring seep (skunk cabbage etc.)

Snags

Standing Dead Wood or Completely or Partially Dead Trees

none	occasional dead branch	dead branches & occ. snag	dead limbs & snags common	5% of tree stems dead	25% dead	dead woods

OLD FIELDS INVENTORY DATA

(Idle or abandoned fields utility right-of-ways, etc.)

"native annuals"	perennial & annual grasses & forbs	herbaceous perennials & a few annuals & to 5% woody	25% briers shrubs & small trees	50% woody	75% woody	sapling trees

Pasture and Hayland Inventory Data

Species Composition

grass	50% grass 50% legume	legume

Management

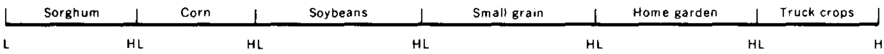
mowed regularly for hay	mowed only annually with fall regrowth	pastured hayland	severely overgrazed pasture	moderately overgrazed pasture	moder-ately grazed pasture	lightly grazed pasture

Residential and Commercial Land Inventory Data

Dominated by large trees						
large lots or estates	small lot-old residential areas	large lots mainly grassland shrubs & golf courses	small lots with considerable shrubbery	small lots or sparsely landscaped townhouses	apart-ment houses & industrial areas	parking lots & heavy industrial areas

CROPLAND INVENTORY DATA

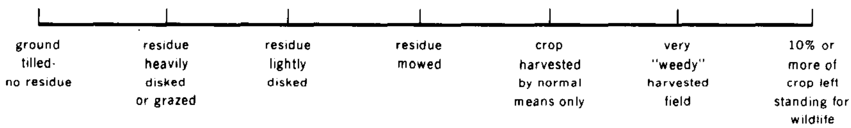
Crop Grown during Summer Growing Season



record as low (L) to high (H) value to wildlife of its growing season management
(i.e., notill planting would rate higher or a large number of weeds would give a higher rating).

Winter Condition of Crop Residue

(During summer inventories the "normal" must be determined)



Winter (Jan-Mar) Condition of Live Herbaceous Growth

(During summer inventories the "normal" must be determined)

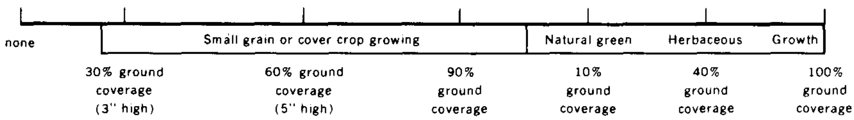


Figure 1. Line charts for inventorying land use, vegetative communities, and other site characteristics considered important in evaluating wildlife habitat in the Seneca Creek watershed.

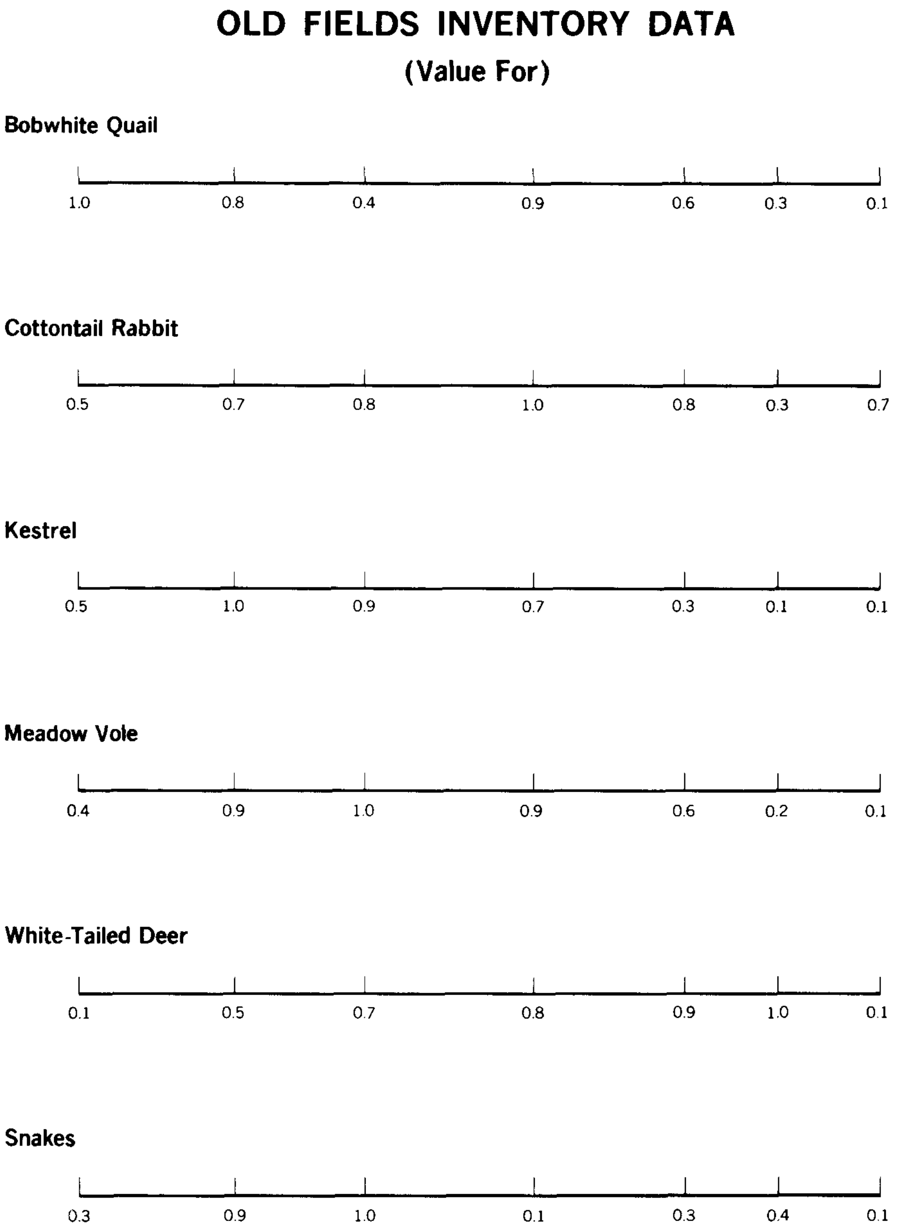


Figure 2. Transformation line charts for converting inventoried characteristics of old fields habitat type to values for selected wildlife species in the Seneca watershed.

WOODLAND TRACT INVENTORY DATA

(Values for White-Tailed Deer)

Tree Stand Characteristics

Average DBH of Canopy Trees (Inches)

a

0.1 .2 0.5 1.2 1.0

Species Composition of Deciduous Trees

b

0.1 0.1 0.4 0.4 1.0 0.8 0.2

Understory Characteristics

Understory (woody vegetation less than 5 ft. high) % Ground Cover

c

0.0 0.3 0.7 1.0 0.5

Understory Species Composition

d

1.0 0.9 0.8 0.6 0.2 0.1

Honeysuckle - % Ground Cover

e

0.0 0.3 0.6 1.0 0.9

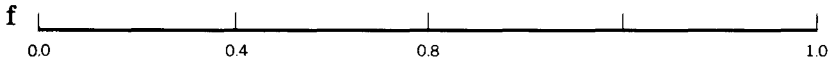
WOODLAND TRACT INVENTORY DATA

Continued

(Values for White-Tailed Deer)

Herbaceous Ground Cover

Herbaceous % Ground Cover



Herbaceous - Species Composition

Organic Ground Cover

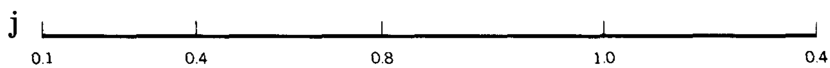
NA

Rock Abundance %

NA

Moisture Condition

Soil Site Moisture



NA

Figure 3. Transformation line charts for converting inventoried characteristics for woodland to habitat values for white-tail deer in the Seneca Creek watershed.

Table 1. Formula used for computing the mean weighted line chart value of woodland habitat in the Seneca Creek Watershed reservoir sites for white-tailed deer.

Values [a]		
(line a + line b) + 2	= tree stand value	× 30 = weighted value
(line c . line d) + line e	= understory value [b]	× 50 = weighted value
(line f .line g)	= herbaceous growth value	× 15 = weighted value
(line j)	= site moisture value	× 05 = weighted value
	Total	100

Total of weighted values ÷ 100 = mean weighted line chart value

[a]The relative value to white-tailed deer of inventoried characteristics of woodlands, Fig. 1, are determined by overlaying it with Fig. 3 and determining the line chart value (of lines a-k).

[b]If value is over 1.0 use 1.0

Table 2. Wildlife values for old field succession habitat in reservoir sites in the Seneca Creek Watershed.

	Site 3		*Site 6*	
Old Field Species	*U.S. Fish & Wildlife Service Value*	*Mean Line Chart Value*	*U.S. Fish & Wildlife Service Value*	*Mean Line Chart Value*
Quail (*Colinus virginianus*)	7.0	0.65	7.0	0.65
Cottontail rabbit (*Sylvilagus floridanus*)	9.0	0.81	8.2	0.70
Kestrel (*Falco sparverius*)	8.0	0.77	7.3	0.65
Meadow Vole (*Microtus Pennsylvanicus*)	10.0	0.95	8.7	0.85
White-tailed deer (*Odocoileus virginianus*)	7.0	0.63	6.1	0.54
Rat snake (*Elaphe sp.*)	6.0	0.56	8.3	0.80
Bluebird (*Sialia sialis*)	9.0	0.88	5.7	0.55
Red fox (*Vulpes fulva*)	8.0	0.77	8.7	0.84
Mockingbird (*Mimus polyglottos*)	8.0	0.73	7.3	0.70
Pheasant (*Phasianus colchicus*)	5.0	0.45	7.0	0.62
Total	77.0	7.20	74.3	6.90
Mean	7.7	0.72	7.4	0.69

of Bailey (1975), by a committee of experienced biologists. Once the standards are agreed upon, they serve as a basis for project evaluation and comparison throughout the region. The line charts would need to be reviewed periodically and modification made if dictated by field experience or research.

It is difficult to categorize natural communities into neat boxes. We found that placing a mark along the line was easier, but in any inventory it is always necessary to keep additional notes to record unusual situations or values. There is considerable opportunity and need for research to refine the inventory line charts and their transformation line charts for specific species. It would also be very beneficial to try out the system in areas of known wildlife populations. Future changes would most likely be in the line chart value transformations. If needed, any previously collected data could be reevaluated.

A major advantage of this system is that it can be readily adapted for computer analysis. McCuen and Whitaker (1975) developed and used a computer program to make the needed transformations and calculations with the collected data to give the habitat area value according to their model. Data collected on the line charts can be analyzed quickly for any species or group of species once the values for each species have been programmed.

Future conditions after various projected changes in the habitat can be readily evaluated using the data available on the line charts. Any change in the vegetative community of a site, natural or man induced, will move its location on the line charts. An experienced evaluation team could estimate the expected habitat changes for each project alternative and remark the inventory line chart. Once the effects of proposed projects on wildlife habitat are determined, the amount and methods of mitigation or compensation needed could be determined. Then plans for mitigation or compensation of major adverse effects could be derived.

A line chart system for inventorying and evaluating wildlife habitat can provide a firm foundation for assessing and comparing water resource projects and their alternatives. We believe that this system can, if accepted by wildlife biologists and concerned agencies, overcome many of the difficulties of existing methods and satisfy the basic needs of a standard method.

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